Estuaries Vol. 17, No. 2, p. 321-333 June 1994

Tidal River Sediments in the Washington, D.C. Area. II. Distribution and Sources of Organic Contaminants

TERRY L. WADE
Geochemical and Environmental Research Group
Texas A&M University
833 Graham Road
College Station, Texas 77845

DAVID J. VELINSKY
Interstate Commission on the Potomac River Basin
6110 Executive Boulevard, Suite 300
Rockville, Maryland 20852

ELI REINHARZ[1]
CHRISTIAN E. SCHLEKAT[2]
Maryland Department of the Environment
Ecological Assessment Division
2500 Broening Highway
Baltimore, Maryland 21224

ABSTRACT: **Concentrations of aliphatic, aromatic, and chlorinated hydrocarbons were determined from 33 surface sediment samples taken from the Tidal Basin, Washington Ship Channel, and the Anacostia and Potomac rivers in Washington, D.C. In conjunction with these samples, selected storm sewers and outfalls also were sampled to help elucidate general sources of contamination to the area. All of the sediments contained detectable concentrations of aliphatic and aromatic hydrocarbons, DDT (total dichlorodiphenyltrichloroethane), DDE (dichlorodiphenyldichloroethene), DDD (dichlorodiphenyldichloroethene), PCBs (total polychlorinated biphenyls) and total chlordanes (oxy-, α-, and y-chlordane and cis + trans-nonachlor). Sediment concentrations of most contaminants were highest in the Anacostia River just downstream of the Washington Navy Yard, except for total chlordane, which appeared to have upstream sources in addition to storm and combined sewer runoff. This area has the highest number of storm and combined sewer outfalls in the river. Potomac River stations had lower concentrations than other stations. Total hydrocarbons (THC), normalized to the fine-grain fraction (clay + silt, <63 µm), ranged from 120 µg g^{-1} to 1,900 µg g^{-1} fine-grain sediment. The hydrocarbons were dominated by the unresolved complex mixture (UCM), with total polycyclic aromatic hydrocarbons (PAHs) concentrations ranging from 4 µg g^{-1} to 33 µg g^{-1} fine-grain sediment. Alkyl-substituted compounds (e.g., Cl to C4 methyl groups) of naphthalene, fluorene, phenanthrene + anthracene, and chrysene series dominated the polycyclic aromatic hydrocarbons (PAHs). Polycyclic aromatic hydrocarbons, saturated hydrocarbons, and the unresolved complex mixture (UCM) distributions reflect mixtures of combustion products (i.e., pyrogenic sources) and direct discharges of petroleum products. Total PCB concentrations ranged from 0.075 µg g^{-1} to 2.6 µg g^{-1} fine-grain sediment, with highest concentrations in the Anacostia River. Four to six Cl- substituted biphenyls were the most-prevalent PCBs. Variability in the PCB distribution was observed in different sampling areas, reflecting differing proportion of Aroclor inputs and**

degradation. The concentration of all contaminants was generally higher in sediments closer to o outfalls, with concentrations of total hydrocarbon, PAHs, and PCBs as high as 6,900 μg g^{-1}, 620 μg g^{-1}, and 20 μg g^{-1} fine-grain sediment, respectively. Highest PCB concentrations were found in two outfalls that drain into the Tidal Basin. Concentrations of organic contaminants from sewers draining to the Washington Ship Channel and Anacostia River had higher concentrations than sediments of the mid-channel or river. Sources of PCBs appear to be related to specific outfalls, while hydrocarbon inputs, especially PAHs, are diffuse, and may be related to street runoff. Whereas most point-source contaminant inputs have been regulated, the importance of nonpoint source inputs must be assessed for their potential addition of contaminants to aquatic ecosystems. This study indicates that in large urban areas, nonpoint sources deliver substantial amounts of contaminants to ecosystems through storm and combined sewer systems, and control of these inputs must be addressed.

[1]Current address: National Oceanic and Atmospheric Administration, Damage Assessment Group, Washington, D.C. 20852.
[2]Current address: Science Applications International Corporation, Environmental Research and Analysis Division, 165 Dean Knauss Drive, Narragansett, Rhode Island 02882.

 321 0160-8347/94/020321-13$01.50/0

Introduction

Currently existing National Oceanic and Atmospheric Administration (NOAA), National Status and Trends (NS&T), and Environmental Protection Agency (EPA) Environmental Monitoring and Assessment-Near Coastal (EMAP-NC) programs are concerned with determining the current contaminant status of coastal areas of the United States. In addition, these programs provide information concerning long-term trends for relatively large geographical areas. However, there remains a need for specific studies to address questions of a more local concern. To reduce the input of contaminants to aquatic systems, such as the tidal system around Washington, D.C., regulations of point sources have been implemented. With the reduction of point-source inputs, nonpoint sources such as storm water runoff now must be assessed as input sources of contaminants to aquatic systems.

The paper describes one portion of a study (see Velinsky et al. 1994 and Schlekat et al. 1994, this issue) to determine the distribution of sedimentary organic contaminants on a local scale in the Washington, D.C. area, employing validated analytical methods. An important objective of this study was to establish the importance of combined and storm sewers as sources of contaminants to the sediments of the area. To accomplish this objective, selected storm and combined sewers were sampled, and organic contaminant distributions compared between sewer and river sediments.